Distribution, habitat and conservation status of *Leggadina lakedownensis* (Rodentia: Muridae) in Queensland

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ABSTRACT

The Lakeland Downs Mouse *Leggadina lakedownensis* is one of two species of short-tailed mice endemic to Australia. In Queensland there have been only very few recent sightings, and the species was thought to be restricted to parts of northern Cape York Peninsula. Five new localities are reported, including range extensions to central Queensland. Habitat for the species varies from chenopod to spinifex grasslands, *Melaleuca* woodlands and open savanna *Eucalyptus* woodlands, ranging from tropical coastal esplanades to sub-tropical rangelands. Trap localities encompass altitude from sea level to over 1000 m, and annual rainfall from 600-1800 mm, but are unified by a dense ground cover and waterlogging red or white sandy clays. Some potential threats to these rodent's populations are postulated including loss of ground cover and clearing of habitat in coastal regions. Despite contentions of a plaguing species, this rodent was rarely encountered in areas extensive sampled within its range. Notwithstanding the spate of localities reported here, we caution against the presumption of that *L. lakedownensis* may not be of conservation concern, and suggest knowledge regarding the biology of this species is still deficient.

Key words: *Leggadina lakedownensis,* Queensland, distribution, habitat, conservation, threats

Introduction

The Lakeland Downs Mouse *Leggadina lakedownensis* is one of two species of short-tailed mice endemic to Australia (Watts and Aslin 1981). *Leggadina forresti* is widely distributed throughout inland Australia in a range of grasslands, shrublands and woodlands, and is considered to be one of the continent's more widely distributed rodents (Watts and Aslin 1981). *Leggadina lakedownensis* was separated from specimens previously assigned to *L. forresti* in 1973, via skull morphology and genetic analysis (Watts 1976), and is predominantly distributed in coastal and near-coastal vegetation. The holotype is from Lakeland Downs Station 110 km south of Cooktown, in a region lying directly behind north-eastern Queensland's wet tropical coast (Watts 1976).

Since then, very few records of *L. lakedownensis* have been collected in Queensland, and correspondingly few data are available on the species' distribution and habitat. The species was initially considered to be restricted to a small area in eastern Cape York Peninsula (Watts and Aslin 1981). Two subsequent populations have been identified (Winter and Atherton 1985; Cermak 1996), though it is still reported as having a restricted distribution in Queensland, within three distinct clusters (Covacevich 1995; Menkhorst and Knight 2001). Its distribution in the Northern Territory was also considered limited, but recent re-examination of *Leggadina* material has indicated a much wider extent there than previously thought (Covacevich 1995; Cole and Woinarski 2002). The species also occurs in Western Australia in the Pilbara and the Kimberley (Menkhorst and Knight 2001). This note describes the location and habitat of five new records for *L. lakedownensis*, collected during four vertebrate fauna surveys in northern Queensland. Past records of the species are reviewed, and some comments are made regarding the habitat, distribution and conservation status of *L. lakedownensis* in Queensland.

Study aims and methods

The five localities for *L. lakedownensis* reported here were collected during four vertebrate fauna surveys conducted between 1996 and 2003:

- a survey of species abundance and distribution within the Desert Uplands bioregion (DEU, Fig. 1);
- a survey of the small-scale patterns of distribution in the coastal lowland vegetation of Clemant State Forest, 40 km north of Townsville, and within the Brigalow Belt bioregion (BRB, Fig. 1);
- an inventory and baseline survey of Blackbraes National Park, 180 km north-east of Hughenden, and within the Einasleigh Uplands bioregion (EIU, Fig. 1); and
- a survey of the patterns of fauna and flora in a series of grazing trials at Wambiana Station, 50 km south of Charters Towers, and within the Desert Uplands bioregion (DEU, Fig. 1).

Sampling in all surveys utilised a standardised nested quadrat array (1 ha), modified from Woinarski and Fisher (1995), incorporating four pitfall and twenty small Elliott traps, operated over a 96 hour period (see Kutt 2004 for full description of methods). The Desert Uplands survey sampled 336 quadrats, the Clemant State Forest survey sampled 60 quadrats in both the wet and dry season, the Blackbraes survey sampled 36 set quadrats in the late wet season and the Wambiana survey sampled 40 quadrats, also in both the wet and dry seasons.

All of these study sites lie within Australia's northern tropical savannas. The Desert Uplands is semi-arid in climate (250-750 mm mean annual rainfall), its landscapes dominated by sandstone ranges and sand plains with soils of mostly poor structure and fertility. Vegetation

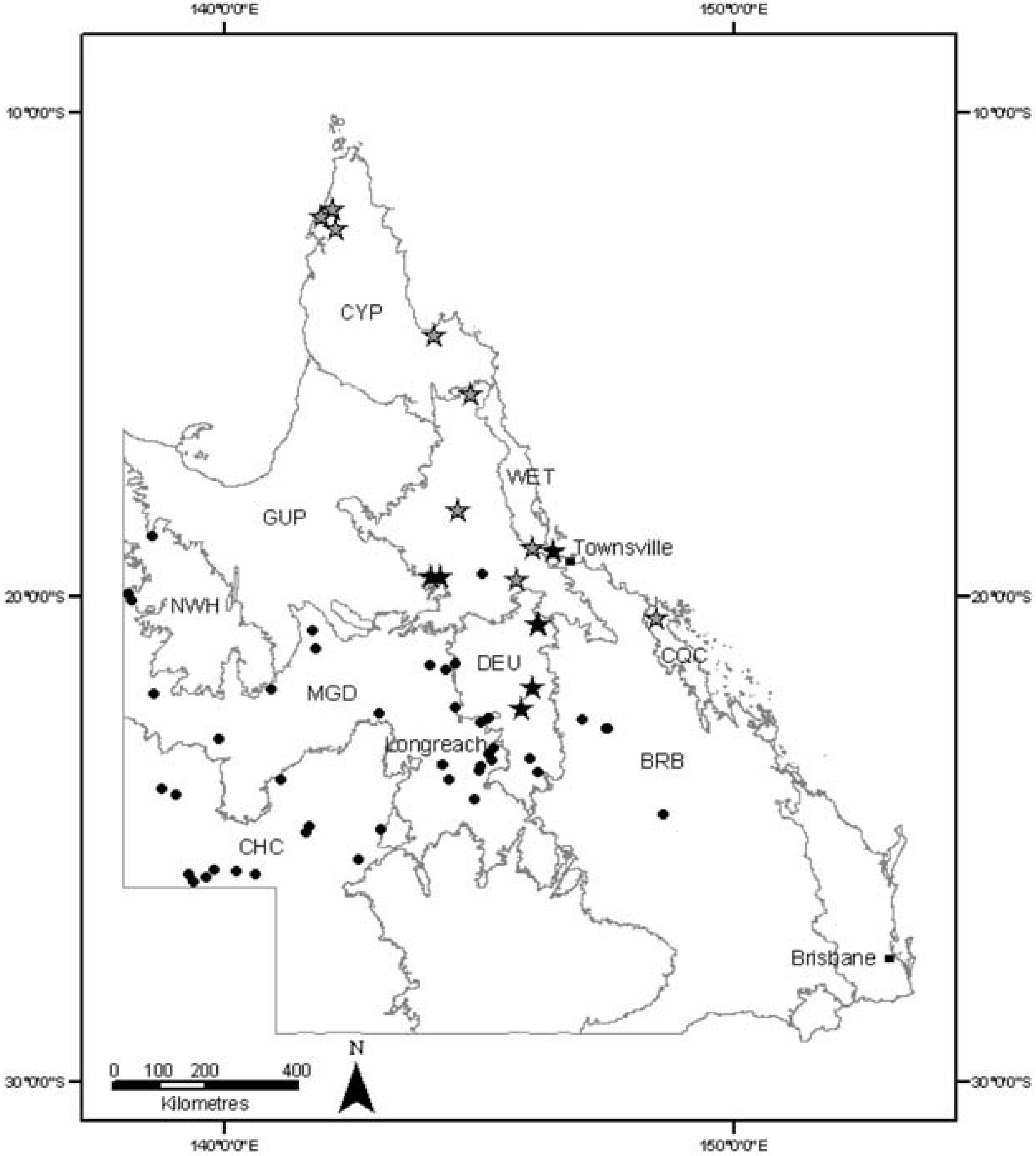

Figure 1. Distribution of *Leggadina lakedownensis* and *L. forresti* in Queensland. Solid black stars represent new localities reported in this study, while grey stars are specimen records from the Queensland Museum. Solid circles identify records of *Leggadina forresti* from the Queensland Museum. Bioregion abbreviations: MGD = Mitchell Grass Downs, DEU = Desert Uplands, BRB = Brigalow Belt, CHC = Channel Country, CQC = Central Queensland Coast, GUP = Gulf Plains, NWH = North-west Highlands, CYP = Cape York Peninsula.

comprises a range of open *Acacia* and *Eucalyptus* woodlands, ephemeral lake and dune systems, hummock, and tussock grasslands (Sattler and Williams 1999). Clemant State Forest is situated on the boundary of the Northern Brigalow Belt and the Wet Tropics (Fig. 1), two of the more biologically diverse and significant bioregions in Queensland. The climate is wet tropical (>1000 mm mean annual rainfall), and the vegetation is predominantly a mixture of low *Melaleuca* spp. woodlands and swamps, open *Eucalyptus* and *Corymbia* woodlands, riparian forest and beach scrub (Kemp *et al.* 1998). Blackbraes National Park lies within the Einasleigh Uplands. This bioregion borders the Northern Brigalow Belt and Desert Uplands to the north (Fig. 1), and consists largely of a series of ranges and plateau surfaces up to 1100m in the east. The geology is complex and includes large areas of basalt flow. Rainfall is high (600-1200mm), and the vegetation is predominantly open *Eucalyptus* woodland. Many large wetland systems occur in the basalt areas (Sattler and Williams 1999).

New localities for *Leggadina lakedownensis*

Clemant State Forest

One adult male (Queensland Museum [QM] Voucher No. JM 12149, weight 16.5 g, snout-vent 71 mm, tail 48 mm) was captured on 16 October 1997 in a pitfall trap (19° 04' 08"S 146° 25' 36"E). A second male was captured at the same site on 21 October 1997 also in a pitfall trap and was released. No measurements were recorded. In this quadrat *L. lakedownensis* was sympatric with an abundant population of *Pseudomys delicatulus*. The site was resurveyed in April 2001 and only *P. delicatulus* was trapped, though in the interim the site had been burnt twice. The vegetation of this site consists of low woodland of *Melaleuca viridiflora* with a sparse mid-storey of *Grevillea pteridifolia* and *Petalostigma banksii* and a ground stratum of *Xanthorrhoea johnsonii*, *Themeda triandra*, *Heteropogon triticeus*, *Eriachne* sp. and *Dimeria* sp. The soils are a white sandy-clays and alluvial in origin. Mean annual rainfall of the area ranges between 900-1200mm and the altitude is <50 m. This area is ungrazed, but is regularly burnt, possibly every 2-3 years.

Moonoomoo Station, 120 km south-east of Charters Towers, Desert Uplands

One adult female (QM Voucher No. JM 12672, weight 22 g, snout-vent 70 mm, tail 43 mm) was captured on 22 November 1998 in a pitfall trap (21° 52' 05"S 146° 01' 55"E). The second (weight 25 g, snout-vent 75 mm, tail 42 mm) was trapped at the same site on 23 November 1998 in an Elliott trap baited with honey, rolled oats and peanut butter, and released. Both animals were pregnant. In this quadrat *L. lakedownensis* was sympatric with *Pseudomys desertor*. The site was resurveyed in September 1999 and only *P. desertor* was trapped. The vegetation of the site consists of open hummock grassland *Triodia longiceps* with occasional patches of the grass *Sporobolus actinocladus*. Soils are poorly drained red sandy-clays. The mean annual rainfall of the area ranges between 600-900 mm and the altitude lies between 300-350 m. The *Triodia* patch was no more than 10 ha, and was embedded within a mosaic of other hummock grassland patches and open woodlands of *E. thozetiana*, Mallee box *E. persistens*, Reid River Box *E. brownii*, Blackwood *Acacia argyrodendron*, Lancewood *A. shirleyi* and Gidgee *A. cambagei*. This site is moderately grazed and rarely burnt except by wildfire.

Fleetwood Station, 120 km north of Aramac, Desert Uplands

A single adult male (QM Voucher No. JM 14293, weight 20 g, snout-vent 70 mm, tail 50 mm) was captured on 1 July 2000 in a pitfall trap (22° 17' 55"S 145° 50" 05"E). In this quadrat the *L. lakedownensis* was sympatric with *Pseudomys desertor*. The site was resurveyed in October 2000 and only *Sminthopsis macroura* was trapped. The vegetation of the site consisted of a low open shrubland of *Halosarcia indica* and *Halosarcia pergranulata*, with a sparse ground strata comprising of grasses (*Sporobolus actinocladus*, *Chloris inflata*, *Enneapogon polyphyllus*), forbs (*Sclerolaena longicuspis*, *Sclerolaena calcarata*, *Dissocarpus biflorus*, *Trianthema triquetra*) and a sedge *Fimbristylis* sp. The soils consist of a thin layer of white sand overlying hard, grey saline clays, which are poorly drained and seasonally inundated. The mean annual rainfall of the area ranges between 600-900 mm and the altitude is 250-300 m. This habitat occurs as a moderately extensive ring of samphire around the ephemeral freshwater lake (Lake Galilee), and lies between the lakebed itself and upper sandy dunes. This site is heavily grazed and adjacent dunes are extensively cleared and sown with the introduced pasture grass *Cenchrus ciliaris*.

Blackbraes National Park, 180 km north-east of Hughenden, Einasleigh Uplands

Two adult males were captured in Elliott traps baited with peanut butter, honey and rolled oats on 27 March 2003, at different trap sites. The first (QM Voucher No. JM 15792, weight 15.5 g, snout-vent 65 mm, tail 47.1 mm) was captured in tall *Eucalyptus* sp. (Stannary Hills G.W. Althofer 402) and *Corymbia citriodora* woodland with a dense ground stratum of *Themeda triandra* and *Heteropogon contortus* (19° 35' 03"S, 144° 13' 52"E). The soils comprised deep red sands on Tertiary plateau. The second, also an adult male (released, weight 20.5 g, snout-vent 73.1 mm, tail 48.6 mm), was captured in *Eucalyptus* sp. (Stannary Hills G.W. Althofer 402), *C. citriodora*, *C. polycarpa* woodland, again with a ground stratum of *Heteropogon triticeus*, *Themeda triandra* and *Bothriochloa pertusa* (introduced Indian Couch). The soils comprised of deep red clay loams. No other mammals were captured at these trap sites, though in adjacent quadrats of similar vegetation types *Pseudomys gracilicaudatus*, *P. delicatulus* and *Mus musculus* were trapped. The annual rainfall of Blackbraes ranges between 600-900 mm and the altitude is between 800-1000 m. This site has been recently gazetted as National Park and is currently being destocked. The first site had been burnt in the preceding six months and the second had not been burnt for over two years.

Wambiana Station 50 km south of Charters Towers, Desert Uplands

Four *L. lakedownensis* were captured in very close proximity at the Wambiana grazing trials. Two adult females and one adult male were captured and released between the 28 and 30 May 2003 in pitfall traps within a "lightly grazed" paddock. The vegetation consisted of open *Eucalyptus melanophloia* and *Corymbia clarksoniana* woodland over a ground stratum of *Schizachyrium fragile* and *Heteropogon contortus* on deep red sands (20° 33' 9"S, 146° 7' 48"E). Another adult male (QM Voucher No. JM 15789) was captured on 30 May 2003 in a pitfall trap within a "rotational grazing" paddock. The vegetation consisted of open *Eucalyptus brownii* woodland over a ground stratum of *Bothriochloa ewartiana* and *Dichanthium fecundum* on brown duplex sandy clays (20° 32' 34"S, 146° 8' 52"E). No other mammals were captured at these trap sites, though in adjacent quadrats of similar vegetation types *P. desertor*, *Rattus rattus* and *M. musculus* were trapped. The mean annual rainfall of the area ranges between 600-900 mm and the altitude is 250-300 m. Unfortunately no morphometric data are available for these animals.

Discussion

Distribution

Leggadina lakedownensis is not as highly restricted in distribution in Queensland as previously thought. The new localities reported for the Desert Uplands extend the known range of the species 300 km south-west, to an area of particular zoogeographic significance on the Great Dividing Range. Under current climatic conditions, a number of related rodent species co-exist parapatrically in this semi-arid zone (Kutt *et al.* 2003), comprising phylogenetically related Eyrean and Torresian forms evolved from a period of Pleistocene divergence and aridity in central Australia (Baverstock 1982). *Leggadina* conforms to this pattern, and in the Desert Uplands, locations for *L. lakedownensis* at Lake Galilee are within 50 km of known *L. forresti* localities, the arid form of this genus (Fig. 1, compare to previous reports of an 800 km gap between the two species in Watts and Aslin 1981). Given the Torresian alliance of *L. lakedownensis*, it is predicted that this species is likely to be distributed, albeit patchily, throughout the Einasleigh Uplands, Northwest Highlands and Gulf Plains Bioregions (Fig. 1), adjoining known populations of the species in the Northern Territory.

Habitat

The pattern of habitat preference was examined by reference to the current data and original reports relating to Queensland Museum records for *L. lakedownensis* (Watts 1976, Covacevich and Easton 1974; Winter and Atherton 1985; Blackman *et al.* 1987; Van Dyck and Birch 1996, Dames and Moore 1996; Cermak 1996). For some records only locality data were available, and as such, very general habitat data were derived from broad vegetation mapping and descriptions (Sattler and Williams 1999) (Table 1). Though such a review is highly qualitative, some simple trends emerge:

- most habitats are mesic, being associated with riparian, lake, littoral or seasonally inundated or waterlogged areas;
- the habitats are structurally quite diverse, ranging from hummock grasslands, tussock grasslands, swamps, sedgelands, to open grassy woodlands, though the presence of a solid ground layer seems consistent;
- soil types are uniformly red (n=9) or white (n=8) sandy-clays; and
- all sites have high to very high annual rainfall (total range 600-1800 mm), but are typically tropical with an intense wet season followed by a long dry.

Table 1. Geographic location, vegetation type, altitude and climate of other known records of *Leggadina lakedownensis* in Queensland. Sources of data are: 1 = Queensland Museum, (vegetation from Sattler and Williams 1999), 2 = Watts (1976), 3 = Covacevich (1995), 4 = Winter and Atherton (1985), 5 = Blackman *et al.* (1987), 6 = Van Dyck and Birch (1996), 7 = Dames and Moore (1996).

Location	Date	Habitat	Rainfall (mm)	Altitude (m)	Source
Kelsey Creek, Proserpine, 20° 26'S 148° 28'E	n/a	Locality now cleared for sugar cane, but previously a mosaic of mixed open *Melaleuca viridiflora, Eucalyptus tereticornis, E. platyphylla* and *Corymbia clarksoniana* woodlands with a dense to sparse tussock grass ground cover. Alluvial sandy-loams.	1200-1800	<50	1
William Island, 14° 37'S 144° 06'E	1969	Mosaic of grasslands, tropical savanna woodlands and riparian forest on alluvial sandy-clays. The area is periodically flooded.	1200-1800	<50	1, 2, 3
Lakeland Downs, 15° 50'S 144° 50'E	1973	Mosaic of open grasslands and open grassy box woodlands (*E. leptophleba, Themeda australis, Heteropogon contortus*) and on red-brown basalt clay soils. Specimens collected in areas sown with *Sorghum* crops.	900-1200	250	1, 2, 3
Mappoon Plains, 11° 59'S 142° 06'E	1980	Ephemeral sedge-land on seasonally inundated marine plains. Cracking grey clays.	1200-1800	<50	4
Batavia Landing, 12° 09'S 141° 54'E	1980	Low *Melaleuca viridiflora* woodland on fine sandy-clay soils. Sparse ground cover of sedges and grasses.	1200-1800	<50	4
Wenlock River, 12° 23'S 142° 10'E	1980	Tall open *Eucalyptus tetrodonta* forest on fine sandy soils. Dense tussock grass ground cover.	1200-1800	<50	4
Hillgrove Station, 19° 38'S 145° 43'E	1980	Open *Eucalyptus* sp. (ironbark), *C. tessellaris, C. clarksoniana, C. dallachiana* forest woodland with tussock grasses e.g. *Heteropogon contortus* in the ground cover. Alluvial river terrace, red massive loamy earths.	600-900	300	5
Hidden Valley,Paluma, 19° 00.8'S 146° 05.3'E	1995	Open *Eucalyptus acmenoides, E. abergiana, E. peltata* woodland, with sparse heath mid-storey on shallow white sandy and stony soils. Moderate grassy ground cover.	600-900	800	6
Ely Camp, Mappoon, 12° 05'S 141° 52'E	1996	Tall open *Eucalyptus tetrodonta* and *Corymbia nesophila* forest with a dense tussock grass ground cover. Deep red earths.	1200-1800	<50	7
Undarra National Park, 18° 13'S 144° 34'E	1996	Unknown. Remains found in cave. Generally mixed *Eucalyptus* spp. and *Corymbia* spp. open woodlands on basalts and laterites.	600-900	600-700	1
Springfield Station, 18° 03'S 144° 49'E	1981	Unknown. Mixed open woodlands predominate in the region.	600-900	600-700	1

Though the sites vary in altitude, the common features are soil type, a tussock or hummock ground cover and climate pattern. This concurs with reported habitat in the Northern Territory; *L. lakedownensis* is restricted to grasslands, particularly wet grasslands on clay soils, with scattered trees and shrubs in an area between 13-16° south (Cole and Woinarski 2002). In Western Australia, habitat in the Pilbara is recorded as stony hummock grassland (Menkhorst and Knight 2001), while on Thevenard Island hummock and tussock grasslands and *Acacia* shrublands on sandy soils are all utilised (Moro and Morris 2000). Additional to these generic descriptions, a number of records in Queensland were derived from open tropical savanna woodlands (Clemant, Blackbraes, Wambiana and see Table 1). The full range of habitat association for *L. lakedownensis* is still acknowledged as poorly known (Cole and Woinarski 2002).

Common or rare?

The reports of *L. lakedownensis* as a seasonally super-abundant rodent deserve some scrutiny. Both the original specimens of *L. lakedownensis* (William Island in 1969, Lakeland Downs in 1973) were collected by hand from "plaguing" populations in cultivated *Sorghum* fields (Watts 1976; Covacevich 1995). These are the only first-hand reports of such an event in the literature. From this observation it was concluded that *L. lakedownensis* was a species likely to exhibit population fluctuations in response to climate and seed availability, with intimation that the oscillation between irruptions to scarcity is a regular occurrence (Watts and Aslin 1981; Covacevich 1995). A study of *L. lakedownensis* on Thevenard Island partly supports this contention, with a pattern of abundance and decline mediated by rain and the maximum period of grass growth, seeding and insect activity after the wet season (Moro and Morris 2000). This is a typical pattern for many species of rodents (Dickman *et al.* 1999).

However, a distinction needs to be made between a species that plagues (compare with *R. villosissimus*, Carstairs 1974), and one simply attuned to a cycle of resource boom and bust. The reports of plaguing imply that this is a general population trait (Watts 1976; Covacevich 1995) and promotes an attitude that the species is generally abundant and common. As with many tropical species, *L. lakedownensis* numbers possibly ebb and flow with climatic and resource variation, with large population increases perhaps only triggered by extreme events (e.g. cyclones). A post-cyclone crash and reinvigoration was recorded on Thevenard Island (Moro and Morris 2000). In this case, the opposite scenario of a species that is typically rare and in very low abundance may be the norm.

As an index of abundance, trapping rates were compared for all small mammal captures in the Clemant State Forest and Desert Uplands survey (Table 2.). Both surveys sampled over moderately long periods of time (3-5 years), and in habitats (tropical woodlands and grasslands) where *L. lakedownensis* occurs. In particular, Clemant State Forest is a highly interconnected mosaic of mesic lowland *Melaleuca* and *Eucalyptus* woodlands. Despite extensive Elliott and pitfall trapping for both surveys (Table 2), only three animals were caught. All trapping included wet and dry seasons and periods of above and below average rainfall (http://www.bom.gov.au/). However, other small mammal species with widespread distribution in open woodlands were also rare despite intensive trapping (e.g. *Rattus tunneyi*, *R. villosissimus*, *Sminthopsis murina*).

Threats to *Leggadina lakedownensis* populations

Restricted populations of low abundance are generally at higher risk from stochastic events, predation and consequent localised extinction (Smith and Quin 1996; Caughley and Gunn 1996). Though in part speculative, three potentially threatening processes to *L. lakedownensis* populations can be identified.

Loss of habitat

Coastal lowland vegetation along the north-east Queensland coast has been targeted for intensive agriculture and urban development. The *L. lakedownensis* site at Kelsey Creek has already been cleared of native vegetation and replaced by sugarcane, and over 80% of this and associated woodland types has been cleared in the Central Queensland Coast bioregion (JEK, unpubl. data). Low open *Melaleuca* woodlands, such as that for the record at Clemant State Forest, have been over 70% cleared in the Wet Tropics bioregion (Kemp and Morgan 1998; Kemp *et al.* 1998). This represents potentially a very substantial loss of habitat, though it is unknown whether *L. lakedownensis* entirely disappear from sites cleared of native tree cover.

Habitat degradation

The decline and extinction of many small, ground-dwelling mammal species has been linked to alteration of ground cover via grazing by stock (Krefft 1886; Lunney 2001). Most *L. lakedownensis* records reported here derive from landscapes where pastoralism is the dominant land use, which suggests a degree of persistence. However, the presence of a reasonable native ground cover seems a unifying factor between localities. In two sites, introduced pasture grasses *Cenchrus ciliaris* and *Bothriochloa pertusa* were present in low abundance, but whether *L. lakedownensis* populations can persevere in areas dominated by an introduced ground stratum is uncertain. Despite reports of *L. lakedownensis* occurring in cultivated *Sorghum* fields (Watts 1976), they have subsequently disappeared from these areas (K. McDonald, QPWS, pers. comm., 2002).

Feral cat predation

There is ample research that shows feral cats and foxes have had a deleterious effect on a variety of small and medium-sized mammals (Dickman 1996; Smith and Quin 1996). There are few feral cat diet data for tropical savannas, except for the Desert Uplands and adjacent Mitchell Grass Downs bioregions (ASK unpubl.), where *L. forresti* was one of the more common mammals prey items taken. As such, there is little reason to discount feral cat predation on *L. lakedownensis* as a threatening process.

Table 2. Composition and frequency of small mammals recorded from two fauna surveys in northern Queensland (Desert Uplands Bioregion and Clemant State Forest) that resulted in *Leggadina lakedownensis* captures. Data indicate the mean abundance per quadrat for all samples and the number in parentheses represents the total number of quadrats in which the species was captured. * indicates introduced species.

Species	Common name	Clemant SF	Desert Uplands
Planigale maculata	Common Planigale	0.38 (16)	0.02 (6)
Planigale ingrami	Long-tailed Planigale		0.006 (1)
Planigale tenuirostris	Narrow-nosed Planigale		0.01 (2)
Sminthopsis douglasi	Julia Creek Dunnart		0.02 (3)
Sminthopsis macroura	Stripe-faced Dunnart		0.41 (73)
Sminthopsis murina	Common Dunnart	0.06 (2)	0.01 (2)
Leggadina forresti	Desert Short-tailed Mouse		0.01 (2)
Leggadina lakedownensis	Tropical Short-tailed Mouse	0.03 (1)	0.01 (2)
Melomys burtoni	Grassland Melomys	4.32 (28)	
Melomys cervinipes	Fawn-footed Melomys	2.25 (19)	
*Mus musculus**	House Mouse	0.1 (2)	0.51 (46)
Pseudomys delicatulus	Delicate Mouse	1.08 (29)	1.11 (98)
Pseudomys desertor	Desert Mouse		1.40 (89)
Pseudomys gracilicaudatus	Eastern Chestnut Mouse		
Pseudomys patrius	Pebble-mound Mouse		0.03 (5)
*Rattus rattus**	Black Rat		0.002 (1)
Rattus sordidus	Canefield Rat	1.77 (19)	0.003 (1)
Rattus villosissimus	Long-haired Rat		0.06 (5)
Rattus tunneyi	Pale Field Rat	0.03 (1)	
Uromys caudimaculatus	Giant White-tailed Rat	0.05 (3)	
Survey period		1996-2001	1997-2000
No. of quadrat samples		60	336
No. of Elliott trap nights		7200	26880
No. of pitfall trap nights		1440	5376

Though at present potential threats *L. lakedownensis* populations seem mild, a salient parable exists in the decline of the Pale Field Rat *Rattus tunneyi* in Queensland. This species is a folivore restricted to riparian and mesic grassy areas, and prone to local climate-driven irruption (Braithwaite and Griffths 1996). It was once common and even occurring in plantation and agricultural areas (McDougall 1944; Kehl 1980). However, it is now rarely encountered in north-eastern Queensland, reduced in distribution possibly due to habitat degradation from introduced herbivores, tree-clearing and weed invasion (Braithwaite and Griffths 1996).

Conservation status

The population and conservation status of *L. lakedownensis* has previously been reported as uncertain, rare or insufficiently known (Ingram and Raven 1991; Covacevich 1995; Lee 1995). In the Northern Territory, *L. lakedownensis* is considered common and seasonally abundant (Woinarski 2000; Coles and Woinarski 2002). Dickman *et al.* (2000) reviewed the status of rodents in Queensland and, using a scoring system that considers population and distribution parameters, these authors suggested that though population size and distribution were moderately small, the species was stable and secure. The additional records reported for the Desert Uplands increase the distribution of the species and would further demote any potential significant status.

However, we argue that adequate data are lacking to characterise accurately a population status in Queensland. IUCN (2000) categories for assessing conservation status include explicit measures of population reduction, extent of occurrence and population estimates. This data can only be inferred for *L. lakedownensis* across Australia (apart for detailed surveyed at Thevenard Island, Moro and Morris 2000). There is also evidence for loss of habitat and populations in some areas of Queensland, and potential degradation to existing habitat via cattle grazing and weed invasion. Therefore, we suggest that classification as data deficient is still a more suitable status. It is recognised that this species is elusive and trap-shy (Cole and Woinarski 2002) and low abundance and absence data for intensive trapping surveys are by nature ambiguous. However, continued evidence for small mammal decline in northern Australian tropical savannas (Woinarski *et al.* 2001) coupled with inadequate survey and species research, suggest a more precautionary approach should be used in assessing the conservation status of yet another inscrutable Australian rodent species.

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References

Baverstock, P.R. 1982. Adaptations and evolution of the mammals of arid Australia. Pp. 175-178 in *Evolution of the Flora and Fauna of Arid Australia*, edited by W.R. Barker and P.J.M. Greenslade. Peacock Publications, South Australia.

Blackman, J.G., Lawrie, B.C. and Locke, D.K. 1987. *Dalrymple Fauna Survey Data Report*. Queensland Parks and Wildlife Service, Townsville.

Bureau of Meteorology 2000. *Queensland Rainfall Data, Data Services, National Climate Centre.* Bureau of Meteorology, Melbourne, http//:www.bom.gov.au.

Carstairs, J.L. 1974. The distribution of *Rattus villosissimus* (Waite) during plague and non-plague years. *Australian Wildlife Research* **1**: 95-106.

Caughley, G. and Gunn, A. 1996. *Conservation Biology in Theory and Practice.* Blackwell Science, Carlton.

Cermak, M. 1996. Gripping feats of the weightlifter mouse. *Geo Australia* **18**: 78-86.

Cole, J. R. and Woinarski, J. C. Z. 2002. *A Field Guide to the Rodents and Dasyurids of the Northern Territory*. Surrey, Beatty and Sons, Chipping Norton, NSW.

Covacevich, J. and Easton, A. 1974. *Rats and Mice in Queensland*. Queensland Museum Booklet No. 9. Queensland Museum, Brisbane.

Covacevich, J. 1995. *Lakeland Downs Mouse Leggadina lakedownensis*. Pp. 556-7 in *The Mammals of Australia,* edited by R. Strahan. Reed New Holland, Sydney.

Dames and Moore Pty Ltd. 1996. *Terrestrial Fauna Technical Report, Ely Bauxite Project*. A Report to Alcan South Pacific Pty Ltd. by Dames and Moore, Brisbane.

Dickman, C.R. 1996. *Overview of the Impacts of Feral Cats on Australian Native Fauna.* Australian Nature Conservation Agency, Canberra.

Dickman, C. R., Mahon, P. S., Masters, P., and Gibson, D. F. 1999. Long-term dynamics of rodent populations in arid Australia: the influence of rainfall. *Wildlife Research* **26**: 389-403.

Dickman, C. R., Leung, L. K-P., and Van Dyck, S. M. 2000. Status, ecological attributes and conservation of native rodents in Queensland. *Wildlife Research* **27**: 347-55.

Franklin, D.C. 1999. Evidence of disarray amongst granivorous bird assemblages in the savannas of northern Australia, a region of sparse human settlement. *Biological Conservation* **90**: 53-68.

Ingram, G. J. and Raven, R. J. (eds). 1991. *An Atlas of Queensland's Frogs, Reptiles, Birds and Mammals.* Queensland Museum, Brisbane.

IUCN. 2000. *IUCN Red List Categories and Criteria (version 3.1).* Gland, Switzerland.

Kehl, J. C. 1980. *The Biology and Population Ecology of Rattus tunneyi culmorum in Hoop Pine Plantations in south-east Queensland.* M.Sc. thesis, Queensland University, Brisbane.

Kemp, J.E. and Morgan, M.G. 1998. *Regional ecosystems and land types of the southern coastal lowlands, Wet Tropics bioregion: Province 2 Tully*. Environmental Protection Agency, Townsville.

Kemp, J.E., Morgan, M.G. and Cumming, R.J. 1998. *Regional ecosystems and land types of the southern coastal lowlands, Wet Tropics bioregion: Province 1 Herbert*. Environmental Protection Agency, Townsville.

Krefft, G. 1866. On the vertebrated animals of the lower Murray and Darling, their habits, economy, and geographical distribution. *Transactions of the Philosophical Society of New South Wales* 1862-1865**:** 1-33.

Kutt, A.S. 2004. *Patterns in the distribution and composition of the vertebrate fauna of the Desert Uplands Bioregion, Queensland.* Unpublished doctoral thesis, James Cook University of North Queensland.

Kutt, A.S., Eddie, C. and Johnson, R. 2003. Eastern range extension of the Sandy Inland Mouse *Pseudomys hermannsburgensis* in central Queensland. *Australian Zoologist* **32**: 252-60.

Lee, A. K. 1995. *The Action Plan for Australian Rodents.* Australian Nature Conservation Agency, Endangered Species Program, Project No. 130.

Lunney, D. 2001. Causes of the extinction of native mammals of the Western Division of New South Wales: an ecological interpretation of the nineteenth century historical record. *Rangeland Journal* **23:** 44-70.

McDougall, W. A. 1944. An investigation of the rat pest problem in Queensland Canefields. 2. Species and general habitats. *Queensland Journal of Agricultural Science* **1:** 48-78.

Menkhorst, P.W. and Knight, F. 2001. *A Field Guide to the Mammals of Australia.* Oxford University Press, Melbourne.

Moro, D. and Morris, K.D. 2000. Population structure and dynamics of sympatric house mice, *Mus domesticus*, and the Lakeland Downs short-tailed mice, *Leggadina lakedownensis*, on Thevenard Island, Western Australia. *Wildlife Research* **27**: 257-68.

Sattler, P. and Williams, R. (eds). 1999. *The Conservation Status of Queensland's Bioregional Ecosystems.* Environmental Protection Agency, Brisbane.

Smith, A. P. and Quin, D. G. 1996. Patterns and causes of extinction and decline in Australian conilurine rodents. *Biological Conservation* **77:** 243-67.

Van Dyck, S. and Birch, J. 1996. *Pebble-mound mice Pseudomys patrius and Pseudomys sp. (Rodentia: Muridae) in Queensland*. A report to the Australian Nature Conservation Agency, Canberra.

Watts, C. H. S. 1976. *Leggadina lakedownensis*, a new species of murid rodent from North Queensland. *Transactions of the Royal Society of South Australia.* **100**: 105-8.

Watts, C. H. S. and Aslin, H. J. 1981. *The Rodents of Australia*. Angus and Robertson Publishers, Sydney.

Winter, J.W. and Atherton, R.G. 1985. *Survey of the Mammals and Other Vertebrates of the Weipa Region, Cape York Peninsula*. Report to Comalco Ltd, Queensland National Parks and Wildlife Service, Brisbane.

Woinarski, J. C. Z. 2000. The conservation status of rodents in the Top End of the Northern Territory. *Wildlife Research* **27:** 421-35.

Woinarski, J.C.Z. and Fisher, A. 1995. Wildlife of lancewood (*Acacia shirleyi*) thickets and woodlands in Northern Australia. 1. Variation in vertebrate species composition across the environmental range occupied by lancewood vegetation in Northern Territory. *Wildlife Research* **22**: 379-412.

Woinarski J. C. Z. and Milne, D. J. and Wanganeen, G. 2001. Changes in the mammal populations in relatively intact landscapes of Kakadu National Park, Northern Territory, Australia. *Austral Ecology* **26**, 360-70.